4.0 ENVIRONMENTAL ANALYSIS

INTRODUCTION TO ENVIRONMENTAL ANALYSIS

Section 4 examines potential environmental impacts of the proposed Project and Project Alternatives. This Section includes analyses of environmental issue areas listed below:

- 4.1 Geological Resources;
- 4.2 Safety;
- 4.3 Hazardous Materials;
- 4.4 Air Quality;
- 4.5 Hydrology, Water Resources, and Water Quality;
- 4.6 Marine Biological Resources;
- 4.7 Terrestrial Biological Resources;
- 4.8 Land Use, Planning, and Recreation;
- 4.9 Public Services;
- 4.10 Transportation and Circulation;
- 4.11 Noise;
- 4.12 Aesthetic/Visual Resources;
- 4.13 Cultural, Historical, and Paleontological Resources;
- 4.14 Energy and Mineral Resources; and
- 4.15 Environmental Justice.

Each environmental issue area analyzed in this document provides background information and describes the environmental setting (baseline conditions) to help the reader understand the conditions that exist currently, prior to project implementation, and the relationship between those existing conditions and potential Project-related impacts. In addition, each section describes the approach to analysis that results in a determination whether an impact is “significant” or “less than significant.” Finally, individual sections recommend mitigation measures (MMs) to reduce significant impacts. Throughout Section 4, both impacts and the corresponding MMs are identified by a **bold letter-number designation** (e.g., Impact **TBIO-1** and **MM TBIO-1a**).

Based on an initial review and analysis, it is likely that the proposed Project would have a less than significant impact, or no impact, on the environmental issue areas identified below. The primary reasons for these determinations are as follows:

- Agricultural Resources. The proposed Project is located on sand and therefore would not impact soils used for agricultural purposes. Further, there are no agricultural activities in the vicinity of the proposed Project.

- Population and Housing. The Project would not require a change in the number of employees and would require only relatively minor new construction and repair-upgrade of existing facilities. The Project would neither induce substantial population growth in the area nor displace any people or housing units.

ASSESSMENT METHODOLOGY

Environmental Baseline

The analysis of each issue area begins with an examination of the existing physical setting (baseline conditions as determined pursuant to section 15125[a] of the State California Environmental Quality Act [CEQA] Guidelines) that may be affected by the proposed Project. The effects of the proposed Project are defined as changes to the environmental setting that are attributable to Project components or operation.

An assumption necessary to ensure consistency with regard to environmental baseline conditions in this EIR is the proposed Project's method of transporting oil (i.e., that the Ellwood Marine Terminal [EMT] will continue to operate through January 2016 and be available to transport produced oil through that time). This incorporates the assumption that Venoco, Inc.'s (Venoco's) lease with University of California, Santa Barbara (UCSB) will permit continued operation of the EMT through January 2016, consistent with existing provisions of that lease. Operation of the EMT until January 2016 may depend upon a renegotiation between UCSB and Venoco regarding the terms of the existing lease to allow cleanup operations to extend beyond the currently required 180 days after January 2016. These cleanup operations would include the EMT site and, potentially, the surrounding Coal Oil Point Reserve. Such an extension may be required, as site cleanup and restoration has the potential to require several years as opposed to the 180 days permitted under provisions of the existing lease.

In addition to the assumption addressing transport of produced oil, as part of the project description, this EIR also analyzes two potential oil transportation options after cessation of EMT operations in 2016: pipeline and trucking. If a pipeline connecting the Ellwood Onshore Facility (EOF) to the All American Pipeline (AAPL) at Las Flores Canyon is approved by the California State Lands Commission (CSLC), the city of Goleta, and Santa Barbara County, this Project would utilize that pipeline as the method for transporting oil. The application to construct this pipeline is currently pending as part of Venoco's Full Field Development proposal and may be considered for approval by the various agencies in late 2007 and 2008. If approved, the pipeline could commence operation sometime between 2009 and 2011. If the pipeline is not constructed, this EIR assumes that after cessation of EMT operations in January 2016, crude oil would be trucked to the Rincon Onshore Separation Facility (ROSF), where it would be piped to refineries in Los Angeles. This would require separate discretionary actions by at least the CSLC, the city of Goleta, and Santa Barbara and Ventura counties. This EIR relies largely upon and incorporates by reference the findings of the EMT EIR regarding potential impacts and MMs associated with these and future transportation options.

<u>Significance Criteria</u>

Significance criteria are identified for each environmental issue area; these criteria serve as benchmarks for determining if a component action will result in a significant adverse environmental impact when evaluated against the baseline. According to the State CEQA Guidelines section 15382, a significant effect on the environment means "…a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project…."

<u>Impact Analysis</u>

Impacts are classified as:

- **Class I** (significant adverse impact that remains significant after mitigation);
- **Class II** (significant adverse impact that can be eliminated or reduced below an issue's significance criteria);
- **Class III** (adverse impact that does not meet or exceed an issue's significance criteria); or
- **Class IV** (beneficial impact).

A determination will be made, based on the analysis of any impact within each affected environmental issue area and compliance with any recommended MM, of the level of impact remaining in comparison to pertinent significance criteria. If the impact remains significant, at or above the significance criteria, it is deemed to be Class I. If a "significant adverse impact" is reduced, based on implementation of identified MMs, to a level below the pertinent significance criteria, it is determined to no longer have a significant effect on the environment (i.e., to be "less than significant," or Class II). If an action creates an adverse impact above the baseline condition, but such impact does not meet or exceed the pertinent significance criteria, it is determined to be adverse, but less than significant (Class III). An action that provides an improvement to an environmental issue area in comparison to baseline conditions is recognized as a beneficial impact (Class IV).

<u>Formulation of Mitigation Measures and Mitigation Monitoring Program</u>

When significant impacts are identified, feasible MMs are formulated to eliminate or reduce the severity of impacts and focus on the protection of sensitive resources. The effectiveness of a MM is subsequently determined by evaluating the impact remaining after its application. Impacts which still meet or exceed the impact significance criteria after mitigation are considered residual impacts that remain significant (Class I). Implementation of more than one MM may be needed to reduce an impact below a level of significance. The MMs recommended in this document are identified in the impact sections and presented in a Mitigation Monitoring Program (MMP), provided in Section 6.

If any MMs are ultimately incorporated as part of a project's design, they are no longer considered MMs under the CEQA. If they eliminate or reduce a potentially significant impact to a level below the significance criteria, they eliminate the potential for that significant impact since the "measure" is now a component of the action. Such measures incorporated into the project design have the same status as any "applicant proposed measures." The CSLC's standard practice is to include all measures to eliminate or reduce the environmental impacts of a proposed project, whether applicant-proposed or recommended mitigation, in the MMP.

<u>Impacts of Alternatives</u>

Section 3 provides a list, description, and map that identify alternatives to the proposed Project. Presentation of each issue area in Section 4 includes the impact analysis for each alternative scenario. A summary of collective impacts of each alternative in comparison with the impacts of the proposed Project is included within the Executive Summary.

<u>Cumulative Projects Impact Analysis</u>

Each issue area in Section 4 presents the cumulative impact scenario, the focus of which is to identify the potential impacts of the Project that might not be significant when considered alone, but that might contribute to a significant impact when viewed in conjunction with the other projects.

4.1 GEOLOGICAL RESOURCES

This section discusses potential geological issues that may be associated with the proposed Project. Specifically, this section focuses on the potential for structural instability of proposed Project facilities given impacts on the Project from (1) seismic hazards including earthquakes, faulting, surface rupture, ground shaking, liquefaction, subsidence, and tsunamis, and (2) coastal processes including erosion, scour, coastal bluff instability and landslides. In addition, this section includes a summary of the existing geologic condition of the reservoir from which the PRC 421 wells have historically extracted oil. The information presented below outlines the environmental setting, regulatory setting, significance criteria, the potential for impacts to the facilities from various geological events, and the significance of these impacts. This section also presents discussions of impacts associated with alternatives to the proposed Project as well as projects identified in the cumulative projects analysis.

This analysis is based on a review of publicly available information on the soils, stratigraphy, and geologic structures present in the study area vicinity. It does not include design-level engineering geology or geotechnical investigations, subsurface explorations, or any laboratory testing of any media, as these analyses are not required by the CEQA.

This document incorporates by reference the conclusions of the EMT EIR regarding geological resources associated with operation of the EMT and summarizes these where appropriate. Where this document relies upon MMs contained in the EMT EIR to address Project impacts, these are summarized to allow report reviewers to understand their relationship to the project.

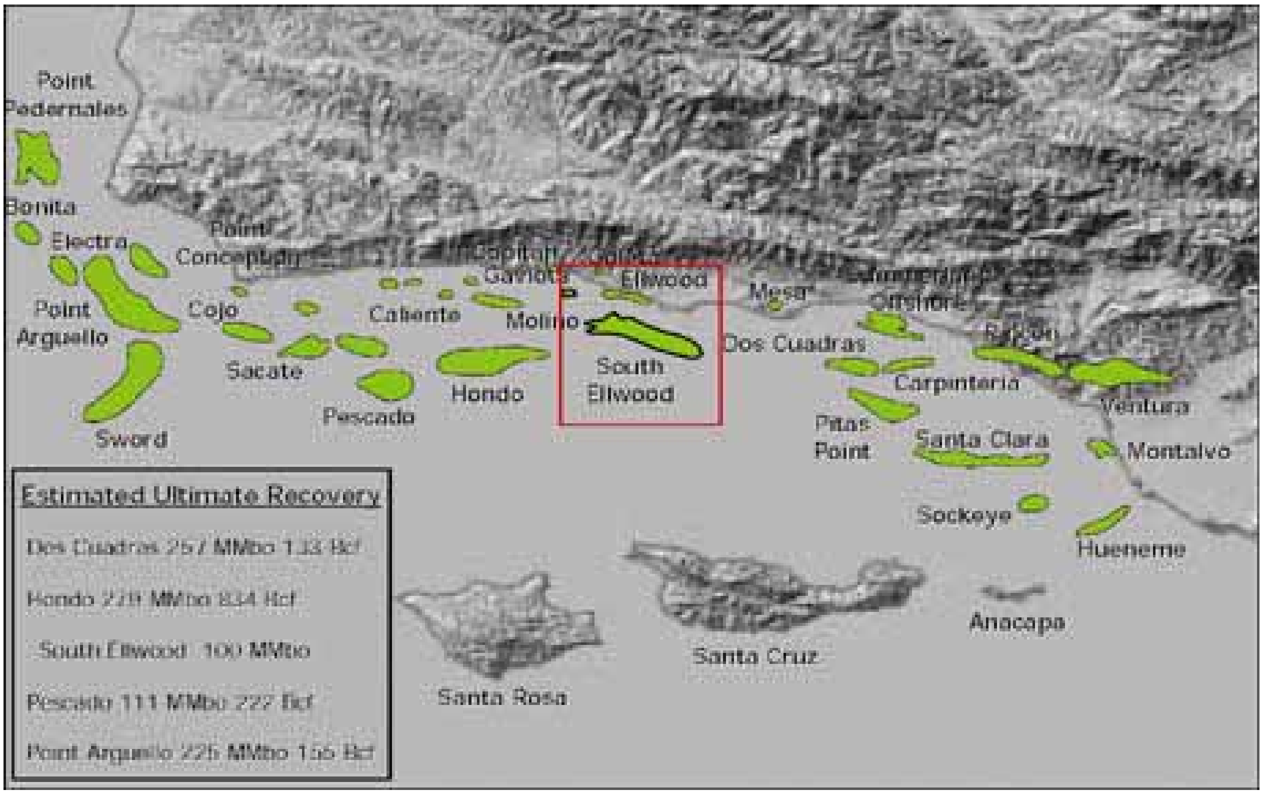
4.1.1 Environmental Setting

<u>Study Area Location and Description</u>

The Project study area comprises the immediate on shore and near-shore areas of the Ellwood coast that would be subject to direct impacts from geologic and structural hazards as a result of implementing the proposed Project. This area includes existing PRC 421 facilities, access road, and the flowline route along the access road, coastal bluff, golf course easement, and tie-in at the existing EOF.

In addition, the environmental setting includes the current pressure regime of the Vaqueros Reservoir, located in the Ellwood Field, and a discussion of other wells that historically produced from the same reservoir. Figure 4.1-1 shows a schematic diagram

FIGURE 4.1-1. MAJOR OIL AND GAS FIELDS OF THE SANTA BARBARA CHANNEL



Source: From Venoco, Inc., presentation titled "Revitalizing South Ellwood Field, Offshore California" (PTTC 2001).

of the Ellwood Oil Field in relation to other oil fields located along the coast in the vicinity of the proposed Project.

<u>Physiography</u>

The two piers are located beneath a coastal bluff that rises approximately 80 feet above mean sea level (msl). The existing access road intersects the bluff at its base (i.e., below 20 feet above msl) to the northwest of the piers near the EOF, and traverses the bluff nearly 20 feet above msl in the direction of the piers to the southeast. To the northeast, a small north-south trending canyon is incised into the bluff where Bell Canyon Creek discharges into the ocean. Another east-west trending gully exists along the bluff above the access road and piers. Accumulations of beach sand deposits exist at the base of the bluff in the surf zone (U.S. Geological Service [USGS] 1995).

The local physiography consists of a wave-cut platform with an associated sea cliff. The cliff marks the locations of older marine terraces which have been uplifted, and the beach marks the modern wave-cut platform. Bell Canyon Creek and the other incision along the sea cliff mark the locations of eroded gullies and/or fault scarps.

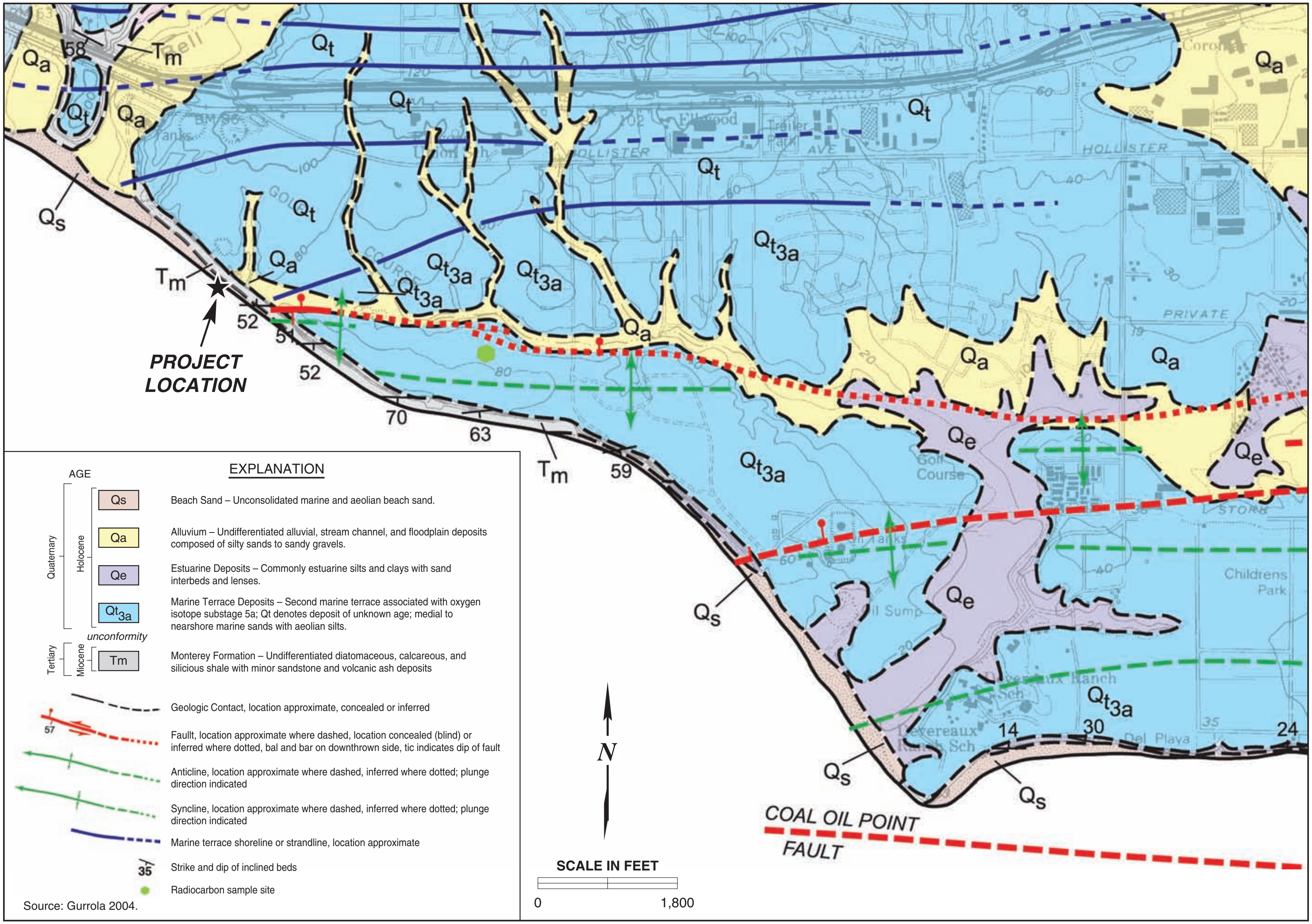
<u>Stratigraphy</u>

The geologic strata exposed onshore in the vicinity of the proposed Project include (Gurrola 2004) (Figure 4.1-2):

- *Quaternary Beach Sand* (Qs)–unconsolidated marine and wind transported beach sand. This unit is exposed along the beach in the surf zone.
- *Quaternary Alluvium* (Qa)–undifferentiated alluvial, stream channel, and floodplain deposits composed of silty sands to sandy gravels. This unit is exposed along Bell Canyon Creek and an unnamed incision near the golf course.
- *Quaternary Marine Terrace Deposits* (Qt and Qt3a)–marine terrace deposits composed of medial to near-shore marine sands and wind transported silts. Based on Gurrola's mapping, there is a sequence of marine terrace deposits. There are also several ancient shorelines, as depicted in Figure 4.1-2 (shown as blue lines), that trend generally east-west across the proposed Project study area. The typical thickness of these deposits is less than 100 feet (City of Goleta 2003).
- *Tertiary Monterey Formation* (Tm)–undifferentiated diatomaceous, calcareous, and silicious shale with minor sandstone and volcanic ash deposits. This unit is exposed along the coastal bluff beneath units Qt and Qt3a. The formation averages approximately 1,000 feet in thickness, and is impregnated with tar. Where exposed, Monterey Formation is usually white and stained with limonite, and the weaker portions are easily eroded by both marine and non-marine processes including wave action, wind erosion and erosion due to rainfall (City of Goleta 2003). The stratigraphy of the offshore area along the continental shelf generally consists of shale deposits overlying the Monterey Formation (PTTC 2001).

In addition to the units exposed at the surface, another unit, the *Tertiary Vaqueros Formation* (Tvq), exists in the subsurface beneath the study area. This unit consists of sandstone with siltstone and shale interbeds and is located approximately 3,000 feet below the ground surface (City of Goleta 2003).

A combination of organic-rich rocks (i.e., containing oil and gas), such as those formed in a marine environment, combined with folds and faults, allows for oil and gas to become trapped in the subsurface. Within the Vaqueros Formation, an oil and gas reservoir exists which has been folded and faulted. The Vaqueros is folded into two



Geology in the Project Area

FIGURE 4.1-2

anticlines. The oil and gas rises to the top of the axes (the top of the center of the folds) of the anticlines where it accumulates. One of the axes of the anticlines (to the southeast – referred to as the eastern high) is higher than the other (the western high), and this corresponds to the location of the PRC 421 wells.

Structure

The proposed Project is located in a tectonically active area. Folds consisting of anticlines (concave down), and synclines (concave up) whose axes trend east-west are shown in Figure 4.1-2 as green dashed lines. Thrust faults (i.e., reverse faults) also trend east-west in the area, and the main faults consist of the More Ranch Fault Zone, Coal Oil Point Fault, and Lavigia Fault (not exposed at the surface in the study area). The folding and faulting in the study area are characteristic of compressional forces caused by tectonic plates moving toward one another (Gurrola 2004).

A study was conducted on the More Ranch faults located just southeast of the proposed Project site, where one of the segments is exposed in the sea cliff at Ellwood Beach. The study results show that the fault deforms the first emergent marine terrace, and is expressed at the surface as a north-facing fold scarp approximately 5 meters high. Additionally, the sea cliff exposure reveals the fault as a south-dipping reverse fault that offsets the Miocene Monterey Formation and wave-cut platform. A channel fill whose upstream reach is Devereux Creek is also exposed along the fold scarp in the sea cliff, and has been truncated by coastal erosion (Keller and Gurrola 2000).

Soils and Soil-Related Hazards

Surface soils in the vicinity of the proposed Project are generally found at the top of the coastal bluff, and were formed in alluvium derived from sedimentary rock. The soils are generally fine sandy loams over dense, very low permeable clay subsoil. The depth to the clay subsoil is approximately 30 inches. Below the bluff, no soils are formed due to active coastal processes.

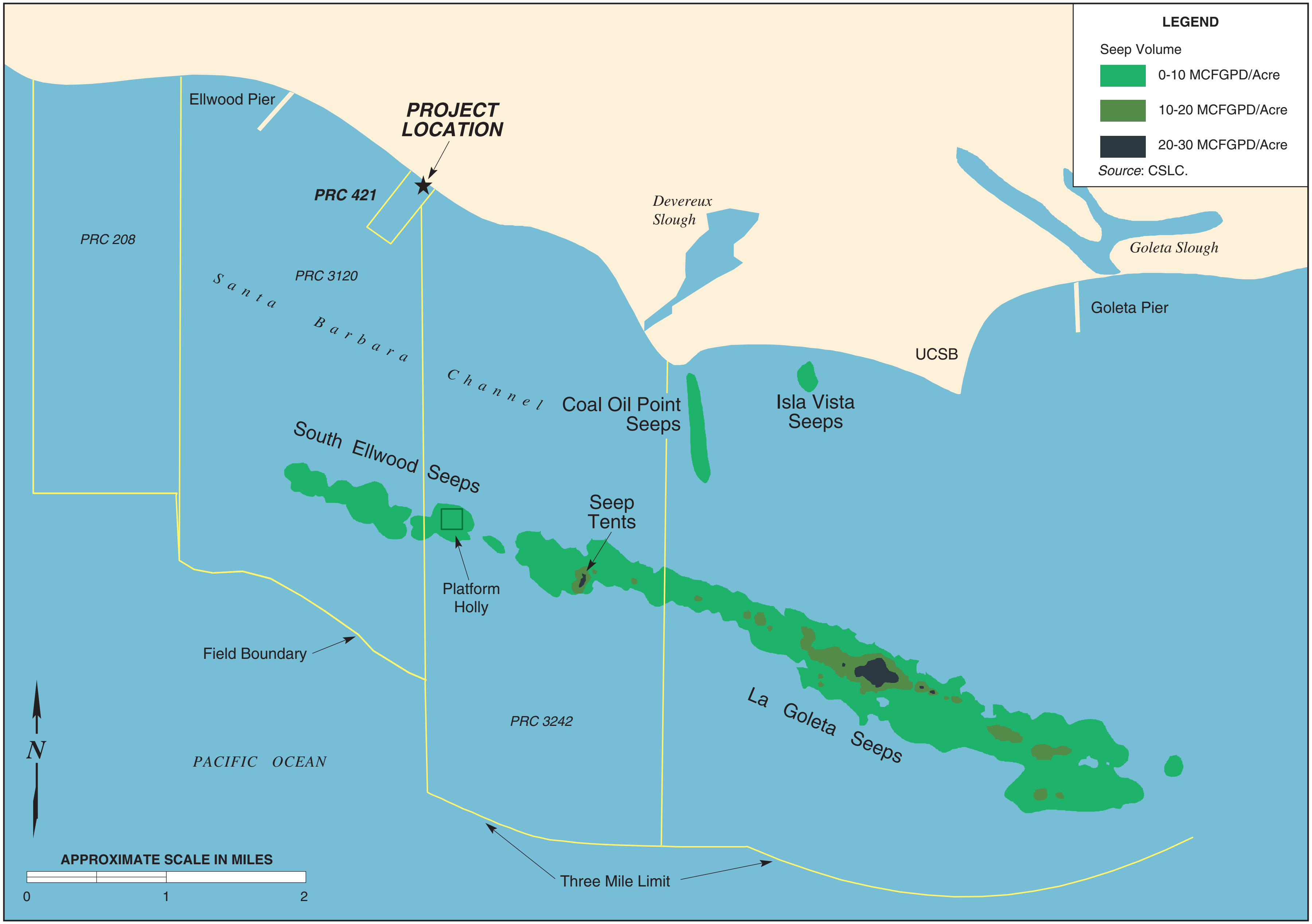
The soils in the vicinity of the proposed Project consist of Goleta Loam with 0 to 2 percent slopes (exposed at EOF and Bell Canyon Creek), Milpitas-Positas Fine Sandy Loams with 9 to 15 percent slopes and 30 to 50 percent slopes, eroded (exposed at EOF and Sandpiper Golf Course), and Diablo Clay with 2 to 9 percent slopes and 9 to 15 percent slopes (exposed southeast of the golf course). The Diablo series soils are well-drained, formed in soft shale and mudstone, with slight to moderate erosion hazards. Goleta Loam is formed on broad floodplains and the hazard of erosion is slight. Milpitas series soils consist of moderately well-drained soils on terraces formed in mixed alluvial deposits, runoff is rapid, and the erosion hazard potential is high (USDA 1981). According to a map of compressible soils, none of the soils within the proposed Project study area are compressible (City of Goleta 2006a). However, the city of Goleta (2003) did indicate that some of the soil types present at the proposed Project area (Diablo and Milpitas) could have high expansion potential whereas the Santa Barbara County has classified the proposed Project study area as having a low to moderate potential of having problems associated with expansive soils (Moore and Taber 1979). Both of these classifications are based on the fact that smectites (a clay mineral group) are present in the study area soils. The origin and type of fill soils used to construct the project access road along the toe of the bluff and their associated characteristics and stability are unknown.

The presence of expansive soils does not constitute a geologic hazard. The hazard arises when clay minerals with expansive potential exist in an environment where they are constantly subjected to periods of wetness and periods of dryness. Buildings and structures developed in these areas can then be damaged due to shrinking and swelling of the clay minerals in the soil beneath the foundations.

The study area includes both onshore and surf zone areas. The structures located in the surf zone (i.e., piers and causeways) would be anticipated to be in a constant state of saturation. Therefore, the risk of damage to the foundations of the piers and causeways is minimal in association with expansive soils, as these soils would not be expected to undergo wetting and drying periods. The onshore areas of the proposed Project located above the high water line could undergo wetting and drying periods, and could include expansive soils.

Natural Oil Seeps

Prolific natural marine hydrocarbon seepage occurs offshore in the vicinity of the proposed Project in the Santa Barbara Channel (Figure 4.1-3) (UCSB 2006; Quigley et al. 1999a; Hornafius et al. 1999). Natural oil and gas have been released from submarine seeps in the Channel for thousands of years. The seeps emit both liquid and gaseous hydrocarbon phases, with gas predominating. The most active gas seeps form visible boils where they intersect the sea surface. Based on the mapping of the seep locations and comparison with other data, the oil and gas are thought to migrate upward through the overlying cap rock (Sisquoc Formation) along fractures on the axis of the South Ellwood anticline and the Coal Oil Point fold complex. The seep locations follow linear trends that mirror the axes of the folds, which suggests that the release of oil and



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Hydrocarbon Seeps in the Project Area

FIGURE 4.1-3

gas along seeps in the Channel is controlled by geologic structure (Bartsch et al. 1999). Seepage is most intense at submarine fault conduits and at structural closures along anticline axes (Quigley et al. 1999a; Hornafius et al. 1999).

Evidence of the natural oil seeps can be directly observed on the beach at the study area. Black tar ball deposits exist and are mixed in with the sand on the beach. Because the natural oil seeps originate offshore, the source of the seeps is not the Vaqueros Formation, the reservoir for the PRC 421 wells. This conclusion is supported by multiple lines of study including seep location, seep discharge, variations of seep emissions through time, and by geochemical analyses performed on oil samples from offshore platforms and beach tar balls. Based on the laboratory analysis, the beach tar ball geochemistry is most similar to oil samples collected from Platform Holly, which produces from the Monterey Formation (Lorenson et al. 2004). Therefore, the tar balls are considered to originate offshore, from where they travel onshore via wave action and other coastal processes.

Faulting and Seismicity

Regional Seismicity

The Santa Barbara/Goleta area is located in the Western Transverse Ranges, which is a seismically active region of Southern California. The North Branch of the More Ranch Fault trends roughly east-west to northwest-southeast less than 0.25 mile south of the Project study area (Gurrola 2004). The More Ranch Fault Zone is classified as *active* by the Santa Barbara County General Plan Safety Element, which is defined by the California Division of Mines and Geology (CDMG) as those along which movement has occurred within the last 11,000 years. *Potentially active* faults have displayed evidence of movement during the past 1.6 million years. *Inactive* faults demonstrate no evidence of movement in the same timeframe (CDMG 1994). However, the More Ranch Fault Zone has not been zoned as *active* by the State of California (Jennings 1994; CDMG 1999), or through the creation of an Alquist-Priolo special studies zone (City of Goleta 2003). The North Branch of the More Ranch Fault has deformed a 45,000-year old marine terrace deposit, and is therefore considered *potentially active* (Gurrola 2004).

The reverse Lavigia Fault, is located beneath the proposed Project area, but is buried in the vicinity of the proposed Project. This fault is believed to act as a trap for oil and gas in the Vaqueros Reservoir at depth and is classified as *potentially active* (Keller and Gurrola 2000).

Ground motion in the vicinity of the Project site is generally the result of sudden movements of large blocks of the earth's crust along *active* faults, which result in an earthquake. Southern California is recognized as one of the most seismically active areas in the United States having been subjected to over 50 major earthquakes of magnitude 6 or greater since 1796. Earthquakes of magnitude 7.8 or greater occur at the rate of about two or three per 1,000 years, corresponding to a 6–9 percent probability in 30 years.

The Santa Barbara/Goleta area has experienced numerous seismic events over the last two centuries, including a few historic large-scale (magnitude greater than 6.0) events, such as the 1812 earthquake, which had a probable Richter magnitude of 7.1 (Toppozada et al. 1981) and likely occurred either offshore, on the San Cayetano Fault to the east (Dolan and Rockwell 2001), or on the Santa Ynez River Fault to the northwest (Santa Barbara County 2004; UCSB 2004; Sylvester and Darrow 1979). Other destructive earthquakes struck the Santa Barbara/Goleta area in 1857 (San Andreas Fault, magnitude 8.4), in 1925 (Santa Barbara vicinity, possibly the More Ranch or Mesa fault, magnitude 6.3), in 1927 (offshore Point Arguello, magnitude 7.3), and in 1978 (offshore North Channel Fault, magnitude 5.9). More recently, a magnitude 4.4 earthquake was centered near the proposed Project in Isla Vista in 2004 (USGS 2004).

During an earthquake along any of the faults, either onshore or offshore in the vicinity of the proposed Project, seismic shaking would be anticipated to occur. Movement along active and potentially active faults in the vicinity including the San Andreas Fault, Santa Ynez/Santa Ynez River Fault Zone, More Ranch Fault Zone, Lavigia Fault, and several others could induce seismic shaking. The proposed Project location is classified as an area where shaking from earthquakes will occur 1 to 2 times per century, and those events will exceed 20 percent of the force of gravity. At this level, significant damage to older buildings is expected to result (Southern California Earthquake Center [SCEC] 1995).

Additional geologic hazards associated with seismicity include surface rupture, liquefaction, subsidence, and tsunamis. These hazards which also have the potential to affect the proposed Project are described in detail below.

Surface Rupture

Surface ruptures comprise the displacement and cracking of the ground surface along a fault trace. Surface ruptures are visible instances of horizontal or vertical displacement, or a combination of the two, typically confined to a narrow zone along the fault. Developments near the More Ranch faults, which would include the proposed Project, would be expected to have the most significant potential to be affected by surface rupture (City of Goleta 2003).

Other Types of Seismic Ground Failure

Differential settlement is a process whereby soils settle non-uniformly, potentially resulting in stress and damage to pipelines or other overlying structures. Such movement can occur in the absence of seismically induced ground failure, due to improper grading and soil compaction or discontinuity of naturally occurring soils; however, strong ground shaking often greatly exacerbates soil conditions already prone to differential settlement, resulting in distress to overlying structures. Elongated structures, such as pipelines, are especially prone to damage as a result of differential settlement.

Lateral spreading is a type of seismically induced ground failure that occurs when cracks and fissures form on an unsupported slope, resulting in lateral propagation and failure of slope material in a downslope direction. This type of failure is common in unconsolidated river or stream bank deposits, where lateral stream scour creates oversteepened banks in unconsolidated silts and sands.

Liquefaction

Liquefaction is a form of earthquake-induced ground failure that occurs primarily in relatively shallow, loose, granular, water-saturated soils. Liquefaction is defined as the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore pressure, which results in the loss of grain-to-grain contact. Unconsolidated silts, sands, and silty sands are most susceptible to liquefaction. While almost any saturated granular soil can develop increased pore water pressures when shaken, these excess pore water pressures can lead to liquefaction if the intensity and duration of earthquake shaking are great enough. During recent large earthquakes where liquefaction occurred, structures that appeared to be most vulnerable to liquefaction included buildings with shallow foundations, railways, buried structures, retaining walls, port structures, utility poles, and towers.

The Santa Barbara County identifies the proposed Project study area as having moderate liquefaction hazard (Moore and Taber et al. 1979). According to the city of Goleta, there is no historical evidence of structures being damaged by liquefaction in the city or adjacent unincorporated portions of Santa Barbara County (City of Goleta 2003). However, areas of beach sand could have a high liquefaction potential, due to unconsolidated sand layers below the water table at shallow depths. During ground shaking, loose saturated soils and beach sands can undergo liquefaction, and differential settlement of buildings and structures can occur. In addition, as noted above, the types of soils used in construction of the project access road are unknown. Portions of this access road appear to be saturated due to inflow from springs in the bluff which may increase the potential for liquefaction of these fill soils of unknown origin.

Subsidence

Subsidence is a type of ground failure, defined as settlement or compression of subsurface soils following the loss of interstitial materials such as water or gas. Subsidence can occur over a broad region or in localized areas, and can occur gradually over time or as a sudden collapse. The loss of interstitial material can result from shaking of the soil mass during an earthquake, or it can result from other non-seismic factors such as the extraction of oil and gas reserves. Because the Vaqueros Reservoir is thought to naturally repressurize due to influx of groundwater into the reservoir rock, subsidence is not expected to occur in the study area as a result of the proposed Project.

Tsunamis

Tsunamis are large ocean waves generated by large-scale, short duration submarine earthquakes, volcanic activity, and submarine landslides. A seismic event on any moderate offshore fault could result in a tsunami in the vicinity of the proposed Project. A major earthquake that occurred off the coast of Point Arguello in 1927 initiated a tsunami, which was recorded on tsunami gages as far away as Hawaii and reached heights of 6 feet above msl along the coast. Another historical tsunami may have resulted from an 1812 earthquake that was generated along a fault in the Santa Barbara Channel (Keller and Gurrola 2000). It is projected that a significant tsunami in the area could affect areas as high as 40 feet above msl, and the areas most susceptible to the effects of a tsunami would be along the oceanfront (Santa Barbara County 2001).

Within the Project vicinity, the stream discharge area of Bell Canyon Creek and the beach area to the southeast of the proposed Project study area are designated as potential tsunami runup areas. The runup area was calculated by the University of Southern California using a tsunami model and potential earthquake sources. The calculated runup area of Bell Canyon Creek includes the area occupied by the EOF (City of Goleta 2006a).

Coastal Process Hazards

Erosion and Scour

Erosion of exposed soils and rocks along the coastal bluff, and in gullies and creeks naturally occurs as a result of physical weathering and ongoing coastal processes. Active erosion caused by water and wind action is evident along the sea cliff where outcrops expose old filled channels and fault planes (Keller and Gurrola 2000). Scour can be considered an aggressive form of water erosion where soil or sediment particles are removed from gullies, creeks, and the sea cliff exposed to wave action. Erosion and scour, while ongoing and naturally occurring in a beach environment, can be affected by human-induced changes including addition of structures, addition of roads, changes to topography, addition of artificial fill, or otherwise general disturbances to the existing natural setting. In areas of increased erosion, deeper incision of gullies and creeks can occur, which causes accumulation of sediments downstream where slopes are less steep and sediments can settle out of the water column. In areas of increased scour, a net increase in removal of mass including soil, sediment (beach sand), and bedrock can occur.

The proposed Project is located within the active wave-cut platform along the coast of the Pacific Ocean. Historical wave-cut platforms and ancient shorelines exist at the top of the coastal bluff, and are marked by emergent marine terraces. The terrace deposits record a geologic history of ongoing coastal erosion processes that have created the sequence of marine terraces. Accumulation and removal of soil (or beach sand) are transient features, and in a wave-cut platform environment, there is an overall net removal of soil, rock, and beach sand. This area has been continually eroded and scoured through time as waves have cut into the existing soil and rock to form the wave-cut platform and coastal bluff. This process would be expected to continue for the foreseeable future (on the order of thousands of years).

The southwest-facing shoreline of the beach in the Project area is subject to direct wave energy which causes off-shore migration of sediments. Sediment removal is greatest in the winter when wave action increases in response to tidal variation (see Section 4.5, Hydrology and Water Quality). Beach width ranges from 35 meters to 90 meters and is subject to seasonal variation and long-term weather patterns including El Niño. A 70-year study of beach width (1938–2003) in the Project area found that beach width was the lowest during 1983 and 1998, following El Niño events (Revell and Griggs 2003). The maximum beach width was observed in 2001 and 2003. The seasonal change in beach width also exposes the pier structures and tops of the caissons to greater level of wave action during winter months.

This continual cutting into the sea cliff by waves will continue to erode the coastal bluff over time.

As mentioned previously, the soils in the vicinity of the proposed Project area are classified as having moderate to high erosion potentials. Because these soils are formed on the terraces at the top of the bluff and along Bell Canyon Creek, there is a potential for these soils to erode. Erosion of the terrace soils could result in downstream sedimentation at the mouth of Bell Canyon on the beach. Any eroded soil or sediment particles from the discharge area at Bell Canyon Creek are likely transported away by wave action and scour processes.

As noted during the first well repair project at PRC 421 in 2001, the existing access road located between the two 421 wells was severely eroded and in need of major repair to allow for vehicle access to the piers. During the initial repair project, approximately 200 tons of rip rap rock was placed within the gaps of the existing beachside rock revetment. This repair included only reinforcement of the existing revetment, and did not include seaward encroachment. The access road also was graded, compacted, and topped with at least 3 inches of road base gravel. Float rock was installed beneath the road base in areas where poor subsurface drainage had been observed.

In 2004, a second repair was needed when a large section of the original outer caisson wall of Pier 421-1 sheared off during a storm. According to the 2006 Mitigated Negative Declaration (MND), the damage had resulted from increased wave action on the structure (City of Goleta 2006b). It is not clear if the caisson design was inadequate, which allowed for the wall to be sheared off, or if the wall had corroded.

Coastal Bluff Instability and Landslides

Because the proposed Project study area includes a coastal bluff, the potential exists for slope failure and landslides to impact the proposed Project. The stability of slopes is affected by a number of factors including gravity, rock and soil type, amount of water present, and amount of vegetation present. The Santa Barbara County Seismic and Safety Element has classified the proposed Project area as having a high potential for slope instability (Moore and Taber 1979).

As noted during the first well repair project at PRC 421 in 2001, failure of the bank below the access road had occurred sometime during the winter of 2000/2001. The bank failure areas were observed where previously buried pipelines were exposed beneath the access road. During the initial repair project, some of the pipelines were removed and the bank failure areas were back-filled. In addition, a French drain and wooden dam were installed to divert water flow around the perimeter of the Pier 421-2 approach area and to relieve hydraulic pressure on the access road. The diverted water is directed onto the beach.

Previous measures to prevent slope undercutting and destabilization included placement of a 12-foot-wide limit to the access road repairs, minimizing cut and fill volumes during access road repairs, and best management practices (BMPs) designed to prevent additional soil erosion during the road repair activities. It appears that the temporary vibrations generated during pile driving in 2001 did not result in further destabilization of the road or slope.

During both well repair projects in 2001 and 2004, issues with a broken sprinkler head and a damaged water line occurred in association with the golf course at the top of the sea cliff. These issues apparently resulted in saturation of soil in some areas of the slope and access road. Saturation of the soil in the slope can contribute to slope failure and landslides.

4.1.2 Regulatory Setting

Federal

The Uniform Building Code (UBC) defines different regions of the United States and ranks them according to their seismic hazard potential. There are four categories of these regions, designated as Seismic Zones 1 through 4, with Zone 1 having the least seismic potential and Zone 4 having the highest seismic potential. The proposed Project area is located within Seismic Zone 4; accordingly, any proposed development or redevelopment would be required to comply with all design standards applicable to Seismic Zone 4.

State

The CSLC issues and administers oil and gas leases covering tide and submerged lands in accordance with the provisions of Division 6, Parts 1 and 2 of the California Public Resources Code (PRC) and pursuant to the regulations set out in Title 2, Division 3 of the California Code of Regulations (CCR). PRC section 6829 includes provisions for specifying methods of operation and standard requirements for conducting operations properly; the prevention of waste, the protection of the safety and health of the workers; and the liability of the lessee for personal injuries and property damage. Section 6829.2 includes provisions for the possible arresting or amelioration of land subsidence. PRC section 6873.2 and section 6873.5 includes provisions for carrying out the requirements of the CEQA.

Articles 3 thru 3.4 of Title 2, Division 3 of the CCR provide regulations covering oil and gas leasing and operating requirements, oil and gas drilling and production regulations and pollution control for leases located on State tide and submerged lands under the jurisdiction of the CSLC. The CSLC regulations are applicable to operations conducted from mobile rigs, fixed offshore structures and upland locations serving these leases. Provision of these articles include protection of human health, regulations on wellhead equipment, subsurface safety valves, surface safety valves, remedial and well maintenance work, supervision and training, anomalous casing annulus pressure, subsurface injection, conversion of a well to fluid injection, waste disposal, pressure relief valves, personal protective equipment, and pipeline inspections.

Article 3.6 of Title 2, Division 3 of the CCR includes requirements for operators to prepare an operations manual describing equipment and procedures which the operator employs or will employ to protect public health and safety and the environment. This article also includes provisions for development and maintenance of emergency response plans that include natural disaster response planning.

State Oil and Gas Lease PRC 421 requires the lessee to comply with all valid laws of the United States and of the State of California, all valid ordinances of cities and counties applicable to the Lessee's operations, Division 3 and 6 of the Public Resources Code, and such rules and regulations as are, or may be issued pursuant thereto.

California Building Code

The State of California provides a minimum standard for building design through the California Building Code (CBC), which is based on the UBC, but has been modified for conditions unique to California. The CBC is selectively adopted by local jurisdictions, based on local conditions. The Project area is located within Seismic Zone 4 of the CBC (Moore and Taber et al. 1979).

Chapter 16 of the CBC contains specific requirements for seismic safety. Chapter 18 of the CBC regulates excavation, foundations, and retaining walls. Chapter 33 of the CBC contains specific requirements pertaining to site demolition, excavation, and construction to protect people and property from hazards associated with excavation cave-ins and falling debris or construction materials. Chapter 70 of the CBC regulates grading activities, including drainage and erosion control. Construction activities are subject to occupational safety standards for excavation, shoring, and trenching, as specified in the State of California Division of Occupational Safety and Health regulations (Title 8 of the California Code of Regulations [CCR]) and in section A33 of the CBC.

The Alquist-Priolo Special Studies Zones Act of 1972

The criteria most commonly used to estimate fault activity in California are described in this act, which addresses only surface fault-rupture hazards. Legislative guidelines to determine fault activity status are based on the age of the youngest geologic unit offset by the fault. This legislation prohibits the construction of buildings used for human occupancy on active and potentially active surface faults. However, only those potentially active faults that have a relatively high potential for ground rupture are identified as fault zones. Therefore, not all potentially active faults are zoned under the Alquist-Priolo Earthquake Fault Zone, as designated by the State of California.

The Seismic Hazards Mapping Act

These regulations were promulgated for the purpose of promoting public safety by protecting against the effects of strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California (CDMG 1997), constitutes the guidelines for evaluating seismic hazards other than surface fault-rupture, and for recommending MMs as required by Public Resources Code section 2695(a). However, to date the California Geological Survey (CGS) has not zoned offshore California under the Seismic Hazard Mapping Act.

California Coastal Act

The California Coastal Air Act (Coastal Act) of 1976 created the California Coastal Commission (CCC) and six area offices, which are charged with granting development permits for coastal projects and for determining consistency between Federal actions and State coastal management programs. Also in 1976, the State legislature created the California State Coastal Conservancy to take steps to preserve, enhance, and restore coastal resources and to address issues that regulation alone cannot resolve. The Coastal Act created a unique partnership between the State (acting through the CCC) and local government to manage the conservation and development of coastal resources through a comprehensive planning and regulatory program. The CCC uses Coastal Act policies as standards in its coastal development permit decisions and for the review of local coastal programs, which are prepared by local governments. Among many issues, the local coastal programs require protection against loss of life and property from coastal hazards, including geologic hazards. This requirement is implemented locally through the Santa Barbara County Comprehensive Plan, Seismic Safety Element.

Local

City of Goleta Ordinances

Development in the city is subject to the city's unified zoning code which includes zoning regulations applicable to both inland and coastal areas, as specified in the 2006 Goleta General Plan/Coastal Land Use Plan (GP/CLUP). Construction of the proposed Project components would be required to conform with the conditions of this zoning code with regard to building standards and best management practices. The city has yet to submit its CLUP to the CCC for adoption, hence the CCC still retains jurisdiction over coastal development.

Santa Barbara County Energy Division

The Santa Barbara County Energy Division provides contract oil and gas project review to the city of Goleta. The Santa Barbara County Energy Division maintains the Systems Safety and Reliability Review Committee (SSRRC) to identify and require correction of possible design and operational hazards for oil and gas projects. The goal of the SSRRC is to substantially reduce the risks of project-related hazards that may result in loss of life and injury and damage to property and the natural environment. The SSRRC is delegated authority to review the technical design of facilities, as well as to review and approve the Safety, Inspection, Maintenance and Quality Assurance Program (SIMQAP) and its implementation, including the conduct of safety audits, review of facility changes, etc. (Santa Barbara County Energy Division 2005).

The 1990 UCSB Long Range Development Plan

The 1990 UCSB Long Range Development Plan (LRDP) was established to identify the physical development necessary to achieve the Campus' academic goals and provide a land use plan to guide the development of future facilities. The LRDP is also intended to respond to the provisions of the California Coastal Act of 1976, with respect to the preparation of Long Range Development Plans for Campuses in the Coastal Zone. A

2006 Amendment to the LRDP addresses seismic fault traces. The Amendment includes policies that address appropriate building setbacks and development standards for construction within or adjacent to seismic fault zones.

4.1.3 Significance Criteria

Impacts are considered significant if any of the following conditions apply:

- Ground motion due to a seismic event that could include surface rupture, liquefaction, subsidence, landslides or tsunami and damage to structural components;
- Substantial soil erosion or the loss of topsoil;
- Unstable soils which result from implementation of the proposed Project and cause landslide, slope failure, lateral spreading, subsidence, liquefaction or collapse;
- Damage of structural components as a result of soil expansion;
- Soil settling that could substantially damage structural components of the wells;
- Deterioration of structural components of PRC 421 due to corrosion, weathering, fatigue, or erosion that could reduce structural stability;
- Damage to petroleum pipelines and/or valves along the pipelines from any of the above conditions that could release crude oil into the environment; or
- Erosion-induced siltation of nearby waterways as a result of ground disturbing activities.

4.1.4 Impact Analysis and Mitigation

The proposed Project was evaluated in an attempt to identify potential geologic hazards that could result in impacts to people or structures over the proposed Project's approximate 12 year production horizon. A qualitative evaluation of potential impacts of the proposed Project was conducted based on the site-specific information described in Section 4.1.1, Environmental Setting.

Implementation of the proposed Project is not anticipated to result in substantial soil erosion or loss of topsoil when compared to the overriding coastal processes of the Pacific Ocean.

The geologic impacts of the proposed Project would be primarily associated with seismic hazards, seismically induced hazards including earthquakes, ground shaking, slope failure and landslides, tsunamis, and coastal-process-related hazards including erosion and coastal bluff instability.

Impact GEO-1: Seismic and Seismically Induced Hazards

Seismic activity along the More Ranch Fault Zone or other regional faults could produce fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure that could expose newly recommissioned project facilities, including caissons, separation equipment, and pipelines to damage during the approximate 12-year lease period (Potentially Significant, Class II).

<u>Impact Discussion</u>

The proposed Project is located in an area that is subject to seismic and seismically induced hazards such as earthquakes, surface rupture, ground shaking, slope failure and landslides, liquefaction, subsidence, and large wave events. If movement were to occur along the active North Branch More Ranch Fault, people or structures in the study area could be exposed to seismic hazards. Given the study area's proximity to this fault segment (less than 0.25 miles away), the potential exists for surface rupture, ground shaking, slope failure and landslides to impact the proposed Project site. Any one of these hazards or a combination of these hazards could occur during the life of the proposed Project, and can neither be accurately predicted nor avoided in the Santa Barbara/Goleta region.

Because the proposed Project is also located along the coast, movement along an offshore fault in the Santa Barbara Channel could result in a large wave event at the study area. The Santa Barbara County has indicated that the wave height in the area could reach as high as 40 feet, which could overtop the piers and access road (see Section 4.2, Safety; Impacts S-2 and S-3).

In addition, some existing Project structures were constructed in 1928, and repairs to portions of the structures in the surf zone were conducted in 2001 and 2004. The design for the most recent repair in 2004 included an assumption that subsurface conditions for the repair were characterized by one soil boring that was completed approximately 80 feet north of the structure in the access road as part of the repair project. The subsurface information obtained from this boring was used in the design. Based on a review of engineering plans associated with those repairs, it also does not appear that the previous engineering designs included seismic loading. Based on this design information, there is a possibility that the proposed Project design is inadequate to sustain the effects of these conditions, which could result in damage to structural components during a seismic event. A seismic event could also cause significant damage to any of sections of the pipeline connecting to Line 96. Therefore, impacts on the proposed Project resulting from seismicity or seismically induced hazards are considered to be significant.

Mitigation Measures

MM GEO-1a. Include Seismic Loading Evaluation. Venoco shall have the caissons at Pier 421-2 and 421-1 evaluated to ensure their ability to withstand effects of dynamic earth pressures, seismic overturning and base sheer, and to support Project facilities through at least the estimated 12-year production life of the facility. Results of the evaluation, together with any redesign plans determined to be necessary to ensure the ability of the caissons to withstand effects of dynamic earth pressures, seismic overturning and base sheer, and to support Project facilities through at least the estimated 12-year production life shall be reviewed and certified by a professional engineer and submitted to the CSLC for approval. Prior to recommencement of production, and subject to receipt of all necessary approvals and permits to undertake the work, Venoco shall construct the necessary improvements to meet the criteria of this mitigation measure.

MM GEO-1b. Field-Verify Subsurface Condition Assumptions. Venoco shall establish a procedure to field-verify that the subsurface conditions used in the design of the repairs at 421-1 caissons are representative of actual conditions to be encountered. The procedure established by Venoco for field-verification shall be submitted to CSLC for approval prior to implementation. If the field conditions encountered require a design modification of the approved repairs, then the revised design plans shall be reviewed and certified by a registered professional structural engineer, and shall be submitted to the CSLC for approval. Prior to recommencement of production, and subject to receipt of all necessary approvals and permits to undertake the work, Venoco shall construct the necessary improvements to meet the criteria of this mitigation measure.

MM GEO-1c. Seismic Inspection. Venoco shall inspect the structures and pipelines following any seismic event in the region (for these purposes defined as Santa Barbara County and offshore waters of the Santa Barbara Channel and Channel Islands) that exceeds a Richter magnitude of 4.0. Venoco shall report the findings of such inspection to the CSLC.

<u>Rationale for Mitigation</u>

Based on the local geologic environment, which includes seismic and seismically induced hazards, the structures should be designed to account for seismic loading. Because the structural components of the PRC 421 piers are located in the surf zone, the potential for a large wave event also exists; therefore, wave loading would also be included in the design (see Section 4.2, Safety; MM S-2b). Seismic inspections would test the effectiveness of the design and ensure that the design is adequate for at least the approximate 12 years or more life of the proposed Project.

Evaluation of the actual subsurface conditions is necessary to ensure that previously made assumptions are sufficient since the design must rely on existing subsurface conditions in the vicinity of the structures. Regular inspections of project facilities, such as pipelines after seismic events would permit timely repairs.

Implementation of MMs GEO-1a through GEO-1c would reduce impacts associated with damage from seismicity to project facilities to less than significant. See also Section 4.2, Safety, for a discussion of accidental release of oil.

Impact GEO-2: Landslide and Slope Failure

The proposed Project would be located on a geologic unit or soil that is unstable, which could create potentially significant damage to the project access road and pipeline from a landslide or slope failure (Significant, Class II).

<u>Impact Discussion</u>

The proposed Project is located within an active wave-cut platform beneath a coastal bluff. All components of the Project (e.g., access road, coastal cliff, piers) are located on soil units or fill that overlie the Monterey Formation. The Monterey Formation is visibly eroded and weathered on the face of the cliff where it is exposed to wave action and other physical and chemical weathering processes. The Monterey Formation and the soils that overlie it in this area are considered to be geologically unstable, and have the potential for slope failure or landslide. The potential instability of the coastal bluff increases when saturated with water, which may occur due to the presence of several springs along the bluff face. Saturation has also occurred from past sprinkler leaks from the Sandpiper Golf Course that reached the bluff. The existing rock revetment reduces but does not eliminate the potential for slope failure. The pipeline that is buried beneath the access road is partially protected from wave-caused erosion by the existing rock revetment, if the revetment is properly maintained (see Impact S-2). However, if the coastal bluff experiences slope failure, the pipeline in the access road may be damaged. Although the proposed Project would include measures to ensure the integrity of this section of pipe (including hydrotesting, internal plastic coating, and enhanced cathodic protection), the pipeline may still be damaged or broken during slope failure or landslide. Therefore, the impact to the proposed Project area that could result from unstable soils or rocks is considered potentially significant (Class II).

Mitigation Measures

MM GEO-2a. Monitor Coastal Bluff and Access Road. The coastal bluff and access road shall be monitored weekly for signs of water saturation, including during and/or heavy rains, or after a sprinkler line leak from the Sandpiper Golf Course. If saturation is apparent, the source of the water infiltration shall be evaluated and removed.

MM GEO-2b. Maintain Existing Seawall and Rock Revetment. The existing seawall and rock revetment shall be routinely inspected for signs of erosion or need for repairs. If eroded areas are observed, these shall immediately be filled in, and any areas in need of repair or addition of rip-rap shall be repaired consistent with applicable permit requirements.

MM GEO-2c. Inspect and Repair Access Road and Pipeline after Landslide Events. The access road and pipeline shall be monitored and repaired after bluff failure or landslide events. In addition to clearing the road of debris, Venoco shall test or inspect the pipeline immediately after any major slope failure to determine if pipeline damage has occurred and implement repairs to this facility.

Rationale for Mitigation

Because water-saturated soils have been observed along the coastal bluff in the past, and because saturation could cause the slope to fail, routine monitoring for water saturated soils is necessary to mitigate the risks associated with a potential slope failure and possible landslide. The seawall and revetment must also be maintained because these structures provide added stability to the base of the bluff, which reduces the potential for slope failure. Although the potential for major bluff failures to occur over the life of the project is unknown, in the event of such a failure, inspection and any required repair of the road and pipeline would be necessary to prevent potential releases of oil.

Impact GEO-3: Soil Settlement and Liquefaction

The recommissioning of PRC 421 could potentially expose Project facilities such as the proposed pipeline and caissons to soil settlement or liquefaction that could damage these facilities, particularly the pipeline (Potentially Significant, Class II).

Impact Discussion

Soils beneath the structural components of the wells are composed of beach sands on the active wave-cut platform. Based on the proposed Project design, the additions to the structural components, including soldier piles, concrete panels, and slurry backfill will be founded in the Monterey Formation, which is the bedrock underlying the beach sands. Because the structural design does not include founding any portions of the structures in the beach sand, settlement of the beach sand beneath the structures would not be anticipated to result in settlement problems beneath the piers.

Other portions of the proposed Project, including the access road, seawall, and revetment may have been constructed on beach sand and may consist of fill soils of unknown origin. The subsurface conditions of the beach sand, including potential for saturated unconsolidated sands are not known. One soil boring was drilled through the access road during the previous caisson wall repair in 2004. However, the subsurface conditions were not logged for the first 20 feet below the surface of the road. Therefore, a potential for settlement and liquefaction of these soils must be assumed until evaluated. If settlement or liquefaction of the fill or soils beneath the access road were to occur, the pipeline in the access road could be damaged and an oil spill could potentially occur. Impacts related to settlement beneath these structural components are considered potentially significant (Class II).

Mitigation Measures

MM GEO-3a. Perform Subsurface Evaluation. An evaluation of soils within and beneath the caissons and access road shall be performed to ascertain potential presence of soils that could settle or become liquefied. The evaluation shall be performed by a California registered Geotechnical Engineer. The conclusions and recommendations shall be incorporated into Project engineering design components for the pipeline, as applicable, and submitted to the CSLC and SSRRC for review and approval.

Rationale for Mitigation

Because the previous subsurface evaluation did not assess the conditions within the upper 20 feet of the ground surface, a subsurface evaluation is needed to address the potential for settlement and/or liquefaction. The findings would be incorporated into the engineering design to improve the ability of the Project structures to withstand expected localized conditions.

If MM GEO-3a is implemented, the potential for damage to the structures would be reduced to less than significant.

Impact GEO-4: Corrosion, Weathering, and Erosion

Corrosion, weathering, fatigue, or erosion could cause deterioration of structural components of PRC 421 (Potentially Significant, Class II).

Impact Discussion

The proposed Project is located in a naturally corrosive and erosive environment. Weathering of soils, rocks, and structures is also active where there is constant action by wind and waves. Previous deterioration of the existing structures has been documented, and resulted in emergency repairs in 2001 and 2004. During those repairs, corrosion of structural components was noted. The design plans for the proposed Project indicate that corrosion protection will be included as part of the upgrades to the existing structural components, including the steel piles and exposed metal. However, the design plans do not include the corrosion protection specifications. Based on the previous issues associated with corrosion, impacts to the proposed Project could be potentially significant, Class II.

Because the geologic environment is highly conducive to physical weathering, the potential exists for impacts associated with weathering of the caisson wall to occur. Further, pipelines and valves associated with the Project may be exposed to cyclic and continual wave action in the surf zone could experience fatigue as a result (see Impact S-2).

With regard to erosion, the designs for the proposed Project indicate that the sheet piles will be founded four inches into the underlying bedrock (Monterey Formation). Based on the continual erosion that occurs at the wave-cut platform on which the structures are located, there is a potential for the sheet pile foundations to be eroded at the base.

Mitigation Measures

MM GEO-4a. Corrosion Protection Design Specifications. The corrosion protection design specifications shall be included on the design drawings. Once included, the revised design plans shall be reviewed and certified by a professional structural engineer, and submitted to the CSLC for approval.

MM GEO-4b. Check Overall Structural Stability against Wind and Wave Action. The design of the proposed Project shall include evaluation of cyclic wind and wave action on structural components. Once included, revised design plans shall be reviewed and certified by a professional structural engineer then submitted to the CSLC for approval.

MM GEO-4c. Evaluate Embedment of Concrete Panels and Lean Concrete Backfill. The design of the proposed Project shall include an evaluation of the potential depth of scour and erosion during the lifetime of the Project within the Monterey Formation in the area of the piers. The concrete shoring panels and lean concrete backfill shall be embedded into the Monterey Formation to a depth greater than the maximum potential scour depth.

MM GEO-4d. Inspect Structures During and/or After Storm Events. Inspections of the structural components including the piers, caissons, causeways, seawall and revetment shall be routinely conducted during and after major storm events.

Rationale for Mitigation

The structural components of the proposed Project would be located in an environment that could cause deterioration if the components are not appropriately designed. Therefore, incorporating these hazards into the structural design should anticipate and prevent potential deterioration. Additionally, once construction is complete, routine inspections of the proposed Project facilities conducted during and after major storm events would ensure that the structural components have not deteriorated and provide opportunities for repairs to be conducted immediately following the detection of any deterioration.

With implementation of MMs GEO-4a through GEO-4d, impacts are anticipated to be less than significant.

Impact GEO-5: Erosion-Induced Siltation

Erosion-induced siltation could occur during ground disturbing activities (Less than Significant, Class III).

Impact Discussion

During the construction phase of the proposed Project, there is a potential for erosion-induced siltation to occur along nearby waterways during ground disturbance activities including trenching for electrical cable installation. However, in compliance with the Clean Water Act (CWA), Venoco would obtain a National Pollutant Discharge Elimination System (NPDES) storm water discharge permit for the construction phase of the Project. Compliance with this permit includes development of a Storm Water Pollution Prevention Plan (SWPPP) prior to beginning the construction of the Project. The SWPPP includes erosion and sedimentation control measures specific to the activities being performed at the construction site. The SWPPP also includes monitoring for sediment and other pollutants in the runoff. Based on implementation of these measures, impacts related to erosion-induced siltation during construction activities would be less than significant (Class III).

Impacts Related to Future Transportation Options

For the purposes of this geological resources impacts analysis, it is assumed that Line 96 and the EMT would be used to transport crude oil recovered from PRC 421 using the barge Jovalan to ship the oil to a Los Angeles or San Francisco Bay area refinery through approximately the year 2013 or beyond. However, as discussed earlier in this EIR (Sections 1.2.4, 2.4.2, and 3.3.6), several options exist for future transportation of oil from the Project, each with different potential geological resources impacts. These include ongoing use of the EMT through 2013, use of a pipeline to Las Flores Canyon, and trucking of oil to Venoco's ROSF Facility 35 miles to the south and subsequent transport to Los Angeles via pipeline. The potential geological resources impacts from transportation using the existing EMT system are fully described above (see Impacts GEO-1 through GEO-5).

However, because the timing and exact mode of transportation of produced oil after the initial five years of Project operation are speculative at this point in time, the potential impacts of use of a pipeline or trucking are only briefly summarized here and are fully disclosed as part of the alternatives analysis (Section 4.1.5). If neither option is permitted nor available by the cessation of operation of the EMT, production from PRC 421 would be stranded, at least temporarily, until an alternative transportation mode is approved and becomes available.

Transportation of oil through an 8.5-mile pipeline from the EOF to the AAPL at Las Flores Canyon could create potentially significant geological resource impacts though exposure of this pipeline to potential damage from geologic forces. Although the timing of construction of the new pipeline is uncertain, transportation of oil via pipeline could commence as early as 2009 or 2010, resulting in 10 or more years of transportation by pipeline. Although pipelines are generally the safest method available for the transportation of crude oil, spills could occur through accidental damage to the pipeline caused by seismic activity, slope failure or flooding. Although of low probability, potentially significant impacts could occur due to damage to the pipeline with the associated potential for a crude oil spill over the approximate 12 year Project production horizon.

Future transportation of oil via a combination of trucking for 35 miles from the EOF to the ROSF and via existing pipeline south to Los Angeles would not be expected to create potentially significant geologic resource impacts beyond those already identified in Impacts GEO-1 through GEO-4 above. Under the proposed Project, trucking would commence no earlier than 2013, and would involve not more than 2 trucks per day carrying 160 barrels of oil each, declining to 1 truck per day in the later years of Project operation (see Section 3.3.6, Transportation Sub-Alternative Options, Table 3-2). Based upon the projected frequency of trucking and the distances traveled, shipment of oil via trucking would not be expected to expose any additional project facilities to significant geological resources impacts. Similarly, the shipment of oil via existing pipeline which already transports substantial amounts of crude oil would not be expected to measurably increase geological resources impacts as the failure rate for such pipelines is a function of pipeline length rather than increased throughput. The pipelines would not be modified by the addition of PRC 421 crude oil; therefore, the spill frequencies for the respective pipeline would be unchanged by the proposed Project.

Table 4.1-1. Summary of Geological Resources Impacts and Mitigation Measures

Impact	Mitigation Measures
GEO-1: Seismic and Seismically Induced Hazards	**GEO-1a.** Include Seismic Loading Evaluation.
	GEO-1b. Field-Verify Subsurface Condition Assumptions.
	GEO-1c. Seismic Inspection.
GEO-2: Landslides and Slope Failure	**GEO-2a**. Monitor Coastal Bluff and Access Road.
	GEO-2b. Maintain Existing Seawall and Rock Revetment.
	GEO-2c. Inspect Access Road and Pipeline after Landslide Events.
GEO-3: Soil Settlement and Liquefaction	**GEO-3a.** Perform Subsurface Evaluation.

Table 4.1-1. Summary of Geological Resources Impacts and Mitigation Measures (continued)

Impact	Mitigation Measures
GEO-4: Corrosion, Weathering, and Erosion	**GEO-4a.** Corrosion Protection Design Specifications.
	GEO-4b. Check Overall Structural Stability Against Wind and Wave Action.
	GEO-4c. Evaluate Embedment of Concrete Panels and Lean Concrete Backfill.
	GEO-4d. Inspect Structures During and/or After Storm Events.
GEO-5: Erosion-Induced Siltation	None Required.

4.1.5 Impacts of Alternatives

No Project Alternative

Under this alternative, there would be no production at PRC 421, and the facilities would be decommissioned (under a separate evaluation). The No Project Alternative would avoid the majority of impacts associated with production, transfer, and transportation of crude oil produced from PRC 421. However, until the PRC 421 is fully abandoned, potentially significant impacts could occur though collapse of portions of either of the caissons, particularly the seaward facing wall of PRC 421-2 which has not been repaired, which would result in impacts similar to those of the proposed project (see Impacts GEO-1, GEO-4; S-2). In addition, while damage to sections of the aging timber bulkhead or under-engineered portions of the seawall protecting this bulkhead could be of concern due to the possible release of potentially contaminated soil into the surf, impacts would be less than those identified for the proposed Project as damage to the existing 6-inch flow line would not have the potential to release oil or produced water into the environment (see Impact S-3). Potential impacts associated with damage to the existing caissons, seawall and access road under this alternative would be mitigated by expedited abandonment as set forth in MM S-11.

The potential effects of decommissioning the facilities would be evaluated in a separate analysis.

No Project Alternative with Pressure Testing

Under this alternative, pressure testing of the Vaqueros Reservoir would be conducted for a 6- to 12-month period as required by the CSLC. No pile-driving or repairs to caissons would occur. Oil and water emulsion would still be produced as a result of the testing, and would be directed through a new 2-inch hard aboveground pipe to the existing pipeline (with upgrades) to the EOF. Given that the existing structures and pipelines would still be used under this Alternative, facilities would still have the potential to be impacted by geologic hazards. If a seismic event were to occur during the testing period, there is a potential for wells and/or pipelines to be damaged, which could result in an oil spill. Depending upon the seismic event, the risk of loss, injury or death also still exists. Note that a seismic event could result in ground shaking, surface rupture, liquefaction, slope failure and landslide, or a tsunami. However, the very short operating period would greatly reduce the potential for such impacts to occur. Further, all improvements associated with this Alternative would be temporary in nature and full mitigations would not be applied because the structural elements to which the mitigations apply would not be implemented. Finally, if after testing is completed, it is determined that full recommissioning would not be approved, as discussed for the No Project Alternative above, MM S-11, expedited abandonment would be applied.

Additionally, because this alternative includes addition of an aboveground pipe that would carry oil, and this pipe would be located in an erosive area beneath an unstable slope. Therefore, MM GEO-2a through MM GEO-2c would apply for the duration of pressure testing to address these potential short duration impacts (less than one year).

<u>Onshore Oil Separation at the EOF</u>

Under this Alternative, PRC 421-2 would be put into production, the associated additions to the existing 6-inch pipeline would be completed, and the electrical cables would be installed via trenching; however, the separation of oil, gas, and water would occur at the EOF and water would be disposed of at well WD-1. Given that the existing structures and pipelines would still be used under this alternative, the facilities would still have the potential to be impacted by geologic hazards. If a seismic event were to occur, there is a potential for wells, pipelines, and/or oil tanks at the EOF to be damaged, which could result in an oil spill. However, the proposed Project would not increase the risk of a seismic event. All of the MMs would apply: GEO-1a through GEO-1c, GEO-2a through GEO-2c, GEO-3a, and GEO-4a through GEO-4d.

Under this Alternative, Pier 421-1 would not be required for water re-injection and the decommissioning of Pier 421-1 would be accelerated. The accelerated decommissioning would require submittal of a decommissioning plan for Pier 421-1 to the CSLC and the city of Goleta within approximately 6 months of approval of this alternative. The decommissioning plan would be subject to further environmental review

Recommissioning Using Historic Production Methods

Under this Alternative, production would resume at PRC 421 essentially in its historical configuration at the time prior to the wells being shut-in in 1994 while incorporating new technologies to comply with current industrial and environmental standards. Therefore, all of the MMs would apply: GEO-1a through GEO-1c, GEO-2a through GEO-2c, GEO-3a, and GEO-4a through GEO-4d.

Re-injection at Platform Holly

Under this Alternative, all aspects of the Project would remain the same with the exception that Pier 421-1 would be decommissioned and produced water would be transported via pipeline to Platform Holly and re-injected offshore rather than at 421-1. Therefore, all potential impacts as described under the proposed Project could potentially occur and all MMs would apply: GEO-1a through GEO-1c, GEO-2a through GEO-2c, GEO-3a, and GEO-4a through GEO-4d. However, as described in Section 3.3.5 this Alternative would require the use of an existing 4-inch sub-sea utility line which extends from the EOF to Platform Holly and minor alterations to platform Holly to permit the use of annulus gas for power. The use of an existing utility line from the EOF to Platform Holly for transport of produced water would not be expected to create any potential geologic resource impacts.

Under this alternative, Pier 421-1 would not be required for water re-injection and the decommissioning of Pier 421-1 would be accelerated. The accelerated decommissioning would require submittal of a decommissioning plan for Pier 421-1 to the CSLC and the city of Goleta within approximately 6 months of approval of this alternative. The decommissioning plan would be subject to further environmental review.

Transportation Sub-Alternative Options

Pipeline Sub-Alternative

Overall, impacts would be similar to those described for the proposed Project. Seismic impacts would be less for this option because the pipeline would not traverse any active or potentially active faults along the alignment. However, the pipeline would be similarly subject to strong seismically induced ground failure, corrosion, and erosive stream scour. These impacts would be expected to be generally be addressed by application of standard regulatory procedures and pipeline construction specifications.

Potential erosion induced siltation (GEO-5) of local creeks and drainages would be greater because substantially more ground disturbance would occur in association with this option as a result of pipeline excavations and backfilling activities. En route to Las Flores Canyon, the pipeline would traverse several creeks that could be impacted by pipeline construction. This impact would be addressed by the application of standard erosion control BMPs and MMs.

Potential slope stability impacts (GEO-2) would be greater under this method of crude oil transportation because the pipeline alignment would traverse several steep hillsides, including those underlain by the highly unstable Rincon Shale Formation. However, such impacts would be mitigable through standard geotechnical engineering. Overall, geologic impacts would be significant but mitigable (Class II). If this method of crude oil transportation is selected, a more detailed geologic impacts evaluation would be necessary as part of a separate CEQA review.

All other components of the proposed Project would remain the same. Therefore, all potential impacts as described under the proposed Project could potentially occur and all MMs would apply: GEO-1a through GEO-1c, GEO-2a through GEO-2c, GEO-3a, and GEO-4a through GEO-4d.

Trucking Sub-Alternative

Under this option, crude oil would be transported by truck from the EMT to AALP. No additional impacts to geological resources would occur as a result of truck transportation and use of an existing pipeline. All other components of the proposed Project would remain the same. Therefore, all potential impacts as described under the proposed Project could potentially occur and all MMs would apply: GEO-1a through GEO-1c, GEO-2a through GEO-2c, GEO-3a, and GEO-4a through GEO-4d.

4.1.6 Cumulative Projects Impact Analysis

With regard to geologic hazards, implementation of the proposed Project is not anticipated to add to the cumulative impacts of other projects in the area. Because geologic hazards such as seismicity and seismically induced hazards exist in the region that includes the study area, implementation of the proposed Project and other projects would not increase the likelihood of such events.

Structural development of individual projects is subject to code requirements of the CBC and would be completed in accordance with recommendations by a licensed geotechnical engineer and the City of Goleta Community Services Department.

Therefore, impacts associated with cumulative projects in the vicinity of the site would generally be site-specific and less than significant. Impacts to human health associated with potential large oil spills from the EMT are addressed in Section 4.3, Hazards and Hazardous Materials. Therefore, cumulative impacts with regard to geological resources are expected to be less than significant.